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A COMPARISON OF ON-SITE T-SUM OBSERVATIONS IN WALES WITH THOSE ESTIMATED FROM METEOROLOGICAL OFFICE MAPS by C P Roe

Summary

Meteorological Office maps were used during 1983 and 1984 to estimate the date of reaching T-sum 200 at 15 sites in Wales, spanning a height range of 10 to 386 m. These estimates were compared with actual T-sums calculated from on-site temperature recordings.

The maps were accurate to within 3 days either side of T-200 for most sites but slightly larger differences of up to 6 days occured at the higher altitude stations or at those sites situated in a frost hollow (eg. Gogerddan).

One notable exception occured at Llanfair Caereinion during 1983 where T-200 according to the maps came 17 days late. This was because of a cold spell which occured when the actual T-sum had reached 201 and which held the map value at 191 for several weeks.

The maps produced sufficiently close estimates for the sites chosen when one bears in mind that T-200 is not at all a critical time for maximising yield from early nitrogen. Better estimates for sites located on steep north or south facing slopes or at high altitudes might be obtained if careful on-site temperature measurements were taken.

1. Introduction

In January 1983 the Meteorological Office began its T-sum service whereby T-sums for 40Km squares covering the United Kingdom were disseminated at weekly intervals to ADAS (Hume, 1983). An example of a T-sum map for Wales is shown in Figure 1.

Several of our ADAS colleagues in Wales have expressed concern over the apparent disparity between T-sums they have either recorded themselves, or which were obtained from Farmers Weekly, and the Meteorological Office estimates. The concern was such that it was felt necessary to check the validity of the maps for stations in Wales even though Sparks (1983) had already found them to be satisfactory at 5 Welsh sites. To do this 15 sites were chosen spanning a wide geographical area and a height range of up to 400 m (see Figure 2). At each site T-sums were calculated from on-site temperature observations and the date of reaching T-sum 200 was compared with the corresponding date estimated from the maps.

2. Calculation of On-Site T-Sums

T-sum is the accumulation of positive daily mean temperatures from January 1st, ignoring negative mean temperatures. The date of reaching T-sum 200 is suggested as the optimum for spring nitrogen application to grassland for early grazing and this is the date used for the comparison.

The 15 sites chosen represent meteorological stations at which daily recordings of maximum and minimum temperature are made at 0900 GMT each day. Some of the stations, namely Valley, Aberporth, Milford Haven, Brynamman and Rhoose provide observations which are used in the preparation of the maps. These sites do not therefore allow an independent check of the system but the remaining 9 sites do.

3. Estimation of On-Site T-Sum From a T-Sum Map

Figure 1 shows a T-sum map for Wales for week ending 7th February 1984.

The site T-sum is estimated by:

$$\text{mean sea level T-sum} - \frac{\text{altitude correction} \times \text{site altitude in metres}}{100}$$

Example

T-sum at Aberporth, height 133 m, square 132

$$= 232 - \frac{22 \times 133}{100}$$

$$= \underline{203} \text{ day-degrees}$$

In this example T-sums for square 132 were used. For sites near the edge or corner of a square, a better estimate can be obtained by interpolating between values in surrounding squares, as will be shown later. However, one is aware that most people using the maps will only use the T-sum for the square in which their site lies so this has been the approach used here.

4. Results and Discussion

Table 1 shows the date of reaching T-200 for the 15 sites calculated from on-site recordings and estimated from the maps.

At most sites T-sum 200 occurs within 3 days either side of the actual date if the maps are used. In 1983 the maps' estimate was generally too early and in 1984 the reverse was true.

Table 1 highlights several points which are worthy of discussion:-

4.1 Cold spells can produce significant differences between the actual and estimated dates of T-sum 200. For instance at Llanfair Caereinion during 1983, a cold spell occured when the actual T-sum had reached 201 and which suspended the map value at 191 for several weeks. The maps finally reached T-sum 200 17 days late, although in practical terms this is unlikely to have been significant since grass growth would have halted during the cold spell so any applied N could not have been utilised. This illustrates the importance of noting the rate of increase of T-sums and not just the accumulated T-sum to date in deciding when to apply first dressings.

4.2 T-sum estimates from the maps become more unreliable when a site is:

a. distant from stations used in the preparation of the maps;

b. at high altitude;

c. on a steep slope and with a northerly or southerly aspect;

d. not located in flat, open terrain eg. frost hollow.

Moel Cynnedd at 358 m a.s.l. severely tests the system in these respects being more than 50 Km distant and 150 m higher than the nearest meteorological station. In addition the site is in a classic frost hollow at the base of a forested valley with high ground on virtually all sides. Even so the maps perform well with errors of 6 days in 1983 and 2 days in 1984.

Very little is known about the effect of slope and aspect on T-sums and this is one area of work which requires further study.

4.3 Better T-sum estimates can be obtained for those sites near the corner or edge of a square by interpolating between values from surrounding squares. A better estimate for Gogerddan, for instance, can be obtained by using squares 122 and 133. In 1984 using square 122 only gave an estimated T-sum 200 some 6 days late; this was halved when squares 122 and 133 were used.

5. Conclusions

ADAS soil scientists have found in extensive trials that T-sum 200 was not at all a critical time for early nitrogen and that dressings applied at either side of this date gave similar yields, especially on drier ground (Evans, 1984). Thus the error of 3 or so days

between the maps and on-site values at most sites in Wales would appear to be acceptable. At higher altitude sites or at those with steep north or south facing slopes, there might be some advantage in taking accurate on-site temperature recordings.

6. Acknowledgements

The assistance of Iwan Morgan in calculating the T-sums and also of Met 08a who supplied the computer printouts are gratefully acknowledged.

7. References

Evans, C (1984) Timing of Nitrogen for Early Grazing. Powys Digest Divisional Bulletin (February).

Hume, C J (1983) A Comparison of the Routine T-sum Services of the Meteorological Office and of Farmers Weekly in 1983. Agricultural Memorandum No 1008*.

Sparks, W R (1983) ~~Agricultural Memorandum No. 1008.~~ A Comparison of on-site observations of T-sums with values interpolated from synoptic weather data. Agricultural Memorandum No. 993*.(*Copies available from the National Meteorological Office Library, London Road, ~~Bracknell, Berks~~).

Any comments or suggestions on this paper should be sent to the author.

Regional Agro-meteorology Department
WOAD, Trawsgoed
Aberystwyth
Dyfed SY23 4HT

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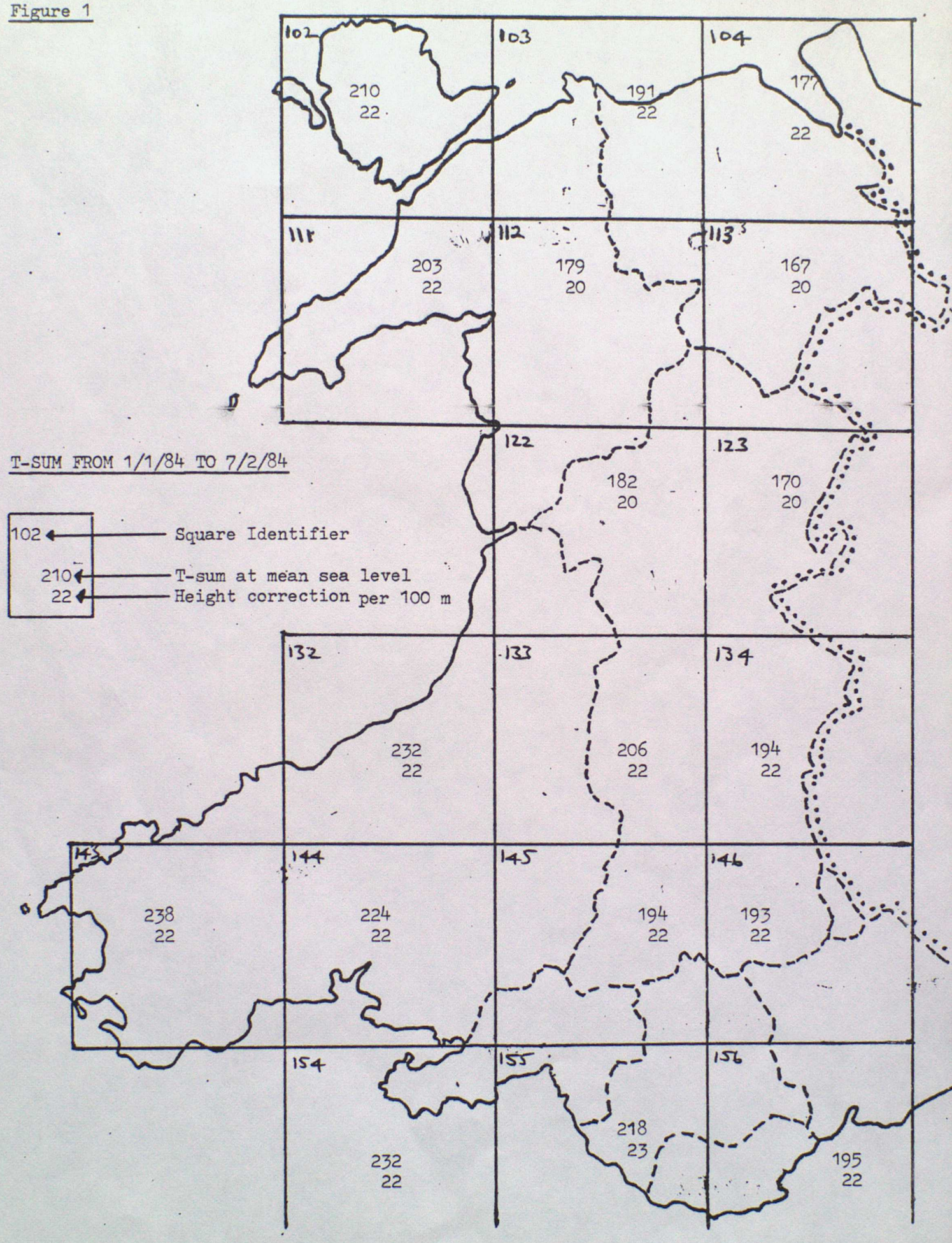
Figure 1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T-SUM FROM 1/1/84 TO 7/2/84
102 Square Identifier
210 T-sum at mean sea level
22 Height correction per 100 m
Miles 10 5 0 10 20 30
Kilometres 10 5 0 10 20 30 40
County and Metropolitan Area Boundary
MAFF Regional Boundary

Figure 2

STATIONS USED IN THE ANALYSIS

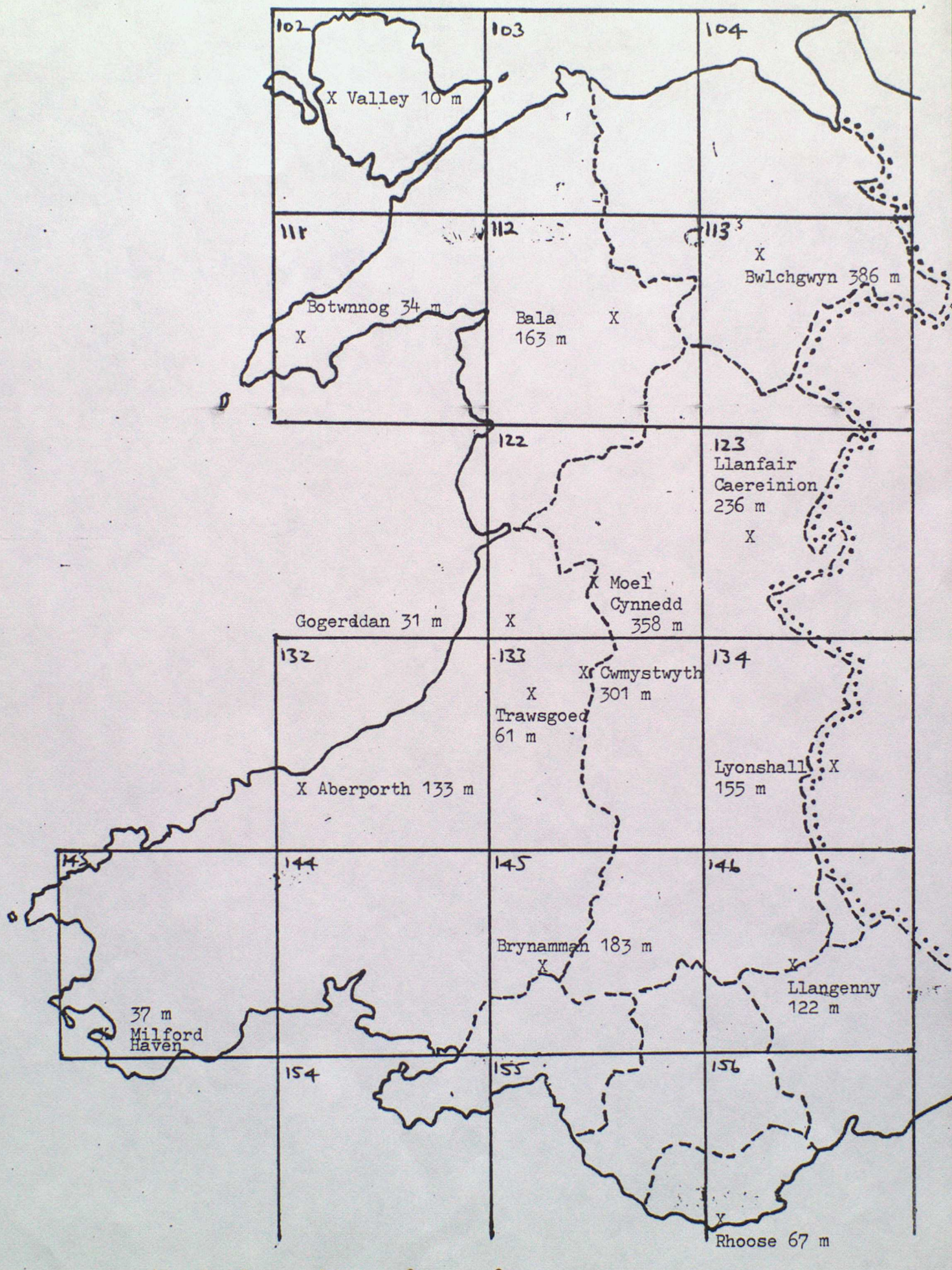

TABLE 1 DATES OF REACHING T-200 1983/84

NO.	STATION	ALTITUDE (m)	1983 E	1983 O	O-E	1984 E	1984 O	O-E
1	Valley	10	27 Jan	28 Jan	1	6 Feb	6 Feb	0
2	Botwnnog	34	27 Jan	29 Jan	2	8 Feb	-	-
3	Bala	163	5 Feb	-	-	26 Feb	23 Feb	-3
4	Bwlchowyn	386	5 Mar	9 Mar	4	-	-	-
5	Gogerddan	31	29 Jan	30 Jan	1	13 Feb	7 Feb	-6
6	Moel Cynnedd	358	1 Mar	7 Mar	6	19 Mar	21 Mar	2
7	Llanfair Caereinion	236	24 Feb	7 Feb	-17	7 Mar	2 Mar	-5
8	Aberporth	133	29 Jan	29 Jan	0	7 Feb	7 Feb	0
9	Trawsgoed	61	30 Jan	30 Jan	0	9 Feb	8 Feb	-1
10	Cwmystwyth	301	24 Feb	26 Feb	2	1 Mar	5 Mar	4
11	Lyonshall	155	2 Feb	31 Jan	-2	20 Feb	20 Feb	0
12	Milford Haven	37	26 Jan	27 Jan	1	4 Feb	2 Feb	-2
13	Brynamman	183	3 Feb	4 Feb	1	21 Feb	20 Feb	-1
14	Llangenny	122	31 Jan	31 Jan	0	16 Feb	17 Feb +	1
15	Rhoose	67	27 Jan	30 Jan	3	12 Feb	10 Feb	-2
				Average O-E	0			1

E - values estimated from maps

O - values calculated from on-site observations

- - missing data

+ - 4 days missing data - estimates of mean temperature used on these days